

WHAT IS CLAIMED IS:

1 1. A heating, ventilation and air conditioning
2 system for use in an automobile, comprising:
3 a casing having a vent outlet;
4 a blower chamber accommodating a blower fan
5 discharging air, said blower chamber being disposed
6 within the casing;
7 a descending air passage communicated with the
8 blower chamber to permit the air from the blower fan
9 to flow downwardly therethrough;
10 an inner wall cooperating with the casing to
11 form the blower chamber and the descending air
12 passage, said inner wall being formed with a recessed
13 portion located near a boundary between the blower
14 chamber and descending air passage;
15 a cooling heat-exchanger adapted to cool the air
16 passing therethrough to produce cool air;
17 an ascending air passage communicated with the
18 descending air passage and the vent outlet to permit
19 the air passing through the descending air passage to
20 flow upwardly therethrough into the vent outlet;
21 a heating heat-exchanger disposed within the
22 ascending air passage and adapted to heat the air
23 passing therethrough to produce warm air, said
24 cooling heat-exchanger being disposed between the
25 blower chamber and the heating heat-exchanger;
26 a bypass air passage juxtaposed to the heating
27 heat-exchanger and communicated with the ascending
28 air passage to permit the cool air from the cooling
29 heat-exchanger to bypass the heating heat-exchanger
30 and flow into the ascending air passage;
31 an air-mix door adapted to control a proportion
32 of the warm air passing through the heating heat-
33 exchanger and the cool air passing through the bypass

34 air passage; and
35 a foot vent passage communicated with the
36 ascending air passage;
37 wherein the heating heat-exchanger is arranged
38 substantially horizontally at the recessed portion of
39 the inner wall and has one end portion adjacent to
40 the recessed portion and an opposite end portion
41 adjacent to the bypass air passage,
42 wherein the bypass air passage and the vent
43 outlet are substantially linearly aligned with each
44 other via the ascending air passage, and
45 wherein the foot vent passage is arranged above
46 the heating heat-exchanger and between the blower
47 chamber and the ascending air passage.

1 2. The system as claimed in claim 1, wherein the
2 cooling heat-exchanger is inclined by a predetermined
3 angle relative to a horizontal plane.

1 3. The system as claimed in claim 2, wherein the
2 cooling heat-exchanger is inclined in a fore and aft
3 direction of the automobile.

1 4. The system as claimed in claim 2, wherein the
2 cooling heat-exchanger is inclined in a width
3 direction of the automobile perpendicular to a fore
4 and aft direction thereof.

1 5. The system as claimed in claim 1, further
2 comprising a partition wall separating the foot vent
3 passage from the ascending air passage, said
4 partition wall comprising an uppermost portion formed
5 with a foot communication opening through which the
6 foot vent passage is communicated with the ascending

7 air passage.

1 6. The system as claimed in claim 5, further
2 comprising a warm air passage disposed downstream of
3 the heating heat-exchanger and communicated with the
4 ascending air passage, said warm air passage guiding
5 the air passing through the heating heat-exchanger
6 toward the bypass air passage side of the ascending
7 air passage.

1 7. The system as claimed in claim 6, wherein the
2 warm air passage is formed by the inner wall and the
3 partition wall.

1 8. The system as claimed in claim 5, further
2 comprising a mode door disposed within the foot
3 communication opening, said mode door being moveable
4 to open and close the foot communication opening.

1 9. The system as claimed in claim 1, further
2 comprising a vent door disposed within the vent
3 outlet, said vent door being moveable to open and
4 close the vent outlet.

1 10. The system as claimed in claim 4, wherein the
2 blower fan is arranged in substantially the same
3 inclined as that of the cooling heat-exchanger.

1 11. A heating, ventilation and air conditioning
2 system for use in an automobile, comprising:
3 a casing having a vent outlet;
4 a blower chamber accommodating a blower fan
5 discharging air, said blower chamber being disposed
6 within the casing;

7 a first air passage substantially vertically
8 extending within the casing and communicated with the
9 blower chamber to permit the air from the blower fan
10 to flow downwardly therethrough;

11 a second air passage substantially vertically
12 extending within the casing and communicated with the
13 first air passage to permit the air passing through
14 the first air passage to flow upwardly therethrough
15 into the vent outlet;

16 a cooling heat-exchanger adapted to cool the air
17 passing therethrough to produce cool air;

18 a heating heat-exchanger arranged substantially
19 horizontally within the second air passage and in an
20 at least partially overlapping relation to the
21 cooling heat-exchanger in a vertical direction, said
22 heating heat-exchanger being adapted to heat the air
23 passing therethrough to produce warm air, said
24 cooling heat-exchanger being disposed between the
25 blower chamber and the heating heat-exchanger;

26 a wall cooperating with the casing to define the
27 blower chamber, the first air passage, the second air
28 passage and a recessed portion located near a
29 boundary between the blower chamber and the first air
30 passage and adjacent to the heating heat-exchanger;

31 a bypass air passage arranged in substantially
32 linear alignment with the vent outlet via the second
33 air passage in the vertical direction, said bypass
34 air passage being juxtaposed to the heating heat-
35 exchanger in a fore and aft direction of the
36 automobile and communicated with the second air
37 passage to permit the cool air from the cooling heat-
38 exchanger to bypass the heating heat-exchanger and
39 flow into the second air passage; and

40 a foot vent passage arranged above the heating

41 heat-exchanger and between the blower chamber and the
42 second air passage, said foot vent passage being
43 communicated with the second air passage.

1 12. The system as claimed in claim 11, wherein the
2 wall comprises an inner wall bent near the boundary
3 between the blower chamber and the first air passage
4 to form the recessed portion, said recessed portion
5 being disposed adjacent to one end portion of the
6 heating heat-exchanger, an opposite end portion of
7 which is disposed adjacent to the bypass air passage.

1 13. The system as claimed in claim 11, wherein the
2 cooling heat-exchanger is inclined by a predetermined
3 angle relative to a horizontal plane.

1 14. The system as claimed in claim 13, wherein the
2 cooling heat-exchanger is inclined by a predetermined
3 angle relative to a horizontal plane in the fore and
4 aft direction of the automobile.

1 15. The system as claimed in claim 13, wherein the
2 cooling heat-exchanger is inclined in a width
3 direction of the automobile perpendicular to the fore
4 and aft direction thereof.

1 16. The system as claimed in claim 11, wherein the
2 wall comprises a partition wall separating the foot
3 vent passage from the second air passage, said
4 partition wall comprising an uppermost portion formed
5 with a foot communication opening communicating the
6 foot vent passage with the second air passage.

1 17. The system as claimed in claim 16, further

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2 comprising a warm air passage disposed downstream of
3 the heating heat-exchanger and communicated with the
4 second air passage, said warm air passage guiding the
5 air passing through the heating heat-exchanger toward
6 the bypass air passage side of the second air passage,
7 said warm air passage being formed by the inner wall
8 and the partition wall.

1 18. The system as claimed in claim 11, further
2 comprising an air-mix door adapted to control a
3 proportion of the air passing through the heating
4 heat-exchanger and the air passing through the bypass
5 air passage.

1 19. The system as claimed in claim 16, further
2 comprising a mode door disposed within the foot
3 communication opening, said mode door being moveable
4 to open and close the foot communication opening.

1 20. The system as claimed in claim 11, further
2 comprising a vent door disposed within the vent
3 outlet, said vent door being moveable to open and
4 close the vent outlet.

1 21. The system as claimed in claim 15, wherein the
2 blower fan is arranged in substantially the same
3 inclined state as that of the cooling heat-exchanger.